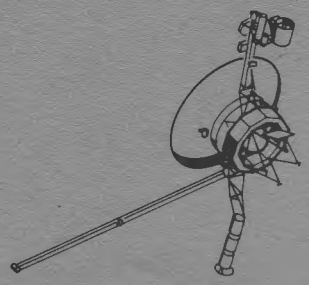

MISSION STATUS BULLETIN

VOYAGER

April 13, 1978 **No. 19**

VOYAGER 2 REESTABLISHES COMMUNICATIONS

Voyager 2 was successfully commanded early Thursday morning using previously untried techniques, after more than a week of radio problems.

Shortly after 3:30 a.m. (PST) Voyager operations sent the first command to the spacecraft through the Madrid tracking station. Just before 4:30 a.m., controllers received confirmation that the command had been received and accepted. It took almost 27 minutes for the command, travelling at the speed of light, to reach the spacecraft, and another 27 minutes for the return flight of the command acknowledgement to reach Earth.

Voyager 2's week-long emergency began April 5 when the backup receiver showed evidence that it was having trouble accepting commands and the spacecraft's primary radio receiver failed. In the event the spacecraft does not receive a command for seven days, it automatically switches to the redundant receiver. That seven-day period was up early Thursday morning, thus allowing a 9-hour sequence of commands to be sent to Voyager 2.

The apparent failure of the backup receiver's tracking loop capacitor means that the receiver can no longer normally follow a changing signal frequency. The difficulty in this is that signals from Earth change in frequency due primarily to

BY JOVE, IT'S JUPITER! This photograph of Jupiter and its four Galilean satellites was taken by Voyager 2 on February 8, 1978, when the spacecraft was 437 million kilometers (271.5 million miles) from the planet. The picture was taken by Voyager 2's narrow-angle camera through a blue filter. North is toward the top with the satellite Europa at left. Io, Ganymede and Callisto, in that order, range outward from the planet to the right. The fuzzy spot in Jupiter's southern hemisphere is not the Great Red Spot, but a reseau mark on the imaging system that was removed by the Image Processing Lab (IPL) at the Jet Propulsion Laboratory (JPL). The Galilean satellites are much dimmer than Jupiter, so the IPL increased their brightness by computer enhancement to make the planet and satellites equally visible. When this image was taken, Voyager 2 was threading its way through the asteroid belt between Mars and Jupiter, and had almost 1-1/2 years of cruise left before it reaches Jupiter in July 1979. The Voyager project is managed for NASA by JPL, California Institute of Technology.

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the doppler effect caused by Earth's rotation. Therefore, spacecraft engineers must determine the frequency at which the receiver is listening, and then compute the frequency at which the Deep Space Station must transmit to send a command.

The doppler effect can be observed by standing, for example, near a railroad crossing and observing an approaching train. As the train approaches, the pitch of its horn (and thus the observed frequency) rises until it passes the observer, and then falls to a lower pitch as the train disappears in the other direction.

The first command sent after Voyager 2 switched to its backup receiver today was transmitted over a rising frequency range, as controllers attempted to determine the frequency to which the receiver is tuned. Later commands zeroed in on this frequency. Commands were sent to prevent turn-on of the X-band transmitter in an effort to prevent temperature changes which could affect the frequency, to prevent switching to the high-gain antenna since it was during such a switch a week ago that the primary receiver failure appeared, and to turn the S-band transmitter to high power so that the spacecraft can be tracked by the 26-meter (85-foot) antennas of the Deep Space Network.

Since the spacecraft emergency was declared a week ago, Voyager 2 has been tracked continuously by the gargantuan 64-meter (210-foot) antennas of the DSN. This has been accomplished with the cooperation of the Viking, Pioneer, and Helios projects which are also tracked by the DSN. Only the 64-meter antennas can receive the S-band low power signals which the spacecraft has been transmitting the past week.

Mission officials are highly optimistic that Voyager 2 will be able to achieve its objectives.

The next automatic cruise sequence is scheduled to be sent to the spacecraft on April 27. It includes Voyager 2's second trajectory correction maneuver (TCM), scheduled for May 3. Further investigation is needed to determine whether this load can and should be transmitted. As a minimum, commands to maintain the high-gain antenna pointed at the Earth, which is essential for communications with the spacecraft, will be transmitted.

VOYAGER 1 QUIET

Activity on Voyager 1 has been quiet as all effort has been concentrated on its sister ship. The photopolarimeter instrument has been turned off as the analyzer wheel is apparently stuck in a manner similar to Voyager 2's, which has been freed.

SUMMARY

Both spacecraft are nearing the center of the asteroid belt which lies between the orbits of Mars and Jupiter.

Voyager 2, travelling at about 19.7 kilometers (12.2 miles) per second relative to the Sun, is more than 474 million kilometers (294 million miles) from Earth, at about 2.8 AU from the Sun. One-way signal time is 26 minutes 16 seconds.
Sun and the Earth, and equals about 150 million kilometers or 93 million miles), and Jupiter's orbit lies ahead at about 5.2 AU. One-way communication time with Voyager 1 is 27 minutes 13 seconds.

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The spacecraft velocities will continue to decrease as they move further into space, as the effect of the Centaur/Propulsion Module boost shortly after launch is gradually overpowered by the gravitational pull of the Sun.